# BOOK REVIEWS

*The Enlightenment of Joseph Priestley: A Study of His Life and Work from 1733-1773 (1997); The Enlightened Joseph Priestley: A Study of His Life and Work from 1773-1804 (2004*). Robert E. Schofield, The Pennsylvania State University Press, University Park, PA.

In the Preface to the first volume of this superb biography the author noted:

> I now present the first fruit of an attempted solution to the Priestley manifold. It is only one of the two volumes I had planned for the complete story of Priestley's life. But volume 2 is not completed and retirement and two bypass operations have forced me to accept temporal realities. I can no longer choose to delay publication of half my work in anticipation of completing the whole.

It was then a marvelous moment when, on August 24, 2004, Robert Schofield, in seeming good health and powerful voice, burst into the final session of the two-day symposium, "Joseph Priestley, Universal Catalyst," waving a copy of the second volume of his *magnum opus*. "It's done;" he roared, "it's finished. No wonder that the opening words in the preface to the new work are *nunc dimittis.*

In the first volume Schofield outlined Priestley's youth and education and his precocious and productive early maturity. Priestley's first publications were products of his pedagogic experiences and his theological reading but their variety still astonishes: language, grammar, rhetoric, history, liberal education, and even perspective. However, as was true throughout his life, theology and religious polemics dominated all else. Priestley's religious beliefs evolved from the Calvinism of his upbringing through gradations that only a theologian can comprehend to end in Unitarianism. Since in late 18$^{th}$-century England such apostasy from the tenets of the established church by a prominent (and vocal) dissenter inevitably led to political controversy, Priestley was soon drawn into the political/religious maelstrom. His association with Lord Shelburne accelerated his transformation from provincial scold to national rebel.

Priestley came late to science and his first endeavors were in the realm of physics. His "A History and Present State of Electricity with Original Experiments," first published in 1767, was to remain in print for more than a century and was to influence Davy, Faraday, and even Maxwell. The subsequent "The History and Present State of Discoveries Relating to Vision, Light and Colours" was less original and also less successful.

Chemistry features only briefly in Schofield's first volume, but it is dealt with in detail in the second. This is divided into four periods: Calne, 1773-1780; Birmingham, 1780-1791; Clapton/Hackney, 1791-1794; and Northumberland, Pennsylvania, 1794-1804. Most of Priestley's immortalizing discoveries came in the first of these periods. However, before the reader gets to the heart of Priestley's chemistry he must make his way through chapters entitled: "Shelburne and Politics," "Religion and Theology," "Common Sense and Associationism," "Matter and Spirit," and "Philosophical Necessity." For a mere chemist unblessed by a philosophical education (though sometimes blessed with a Ph.D.) these chapters are hard going; but if one wishes truly to understand Priestley, the attempt must be made.

Not only did these matters occupy much of Priestley's life but his scientific studies were, in his mind at least, intimately connected with them.

It is with a sense of relief that one reaches Chapters VI and VII where Schofield gives a masterly account of Priestley's experimental chemistry and theoretical musings. All chemists know that Priestley was a great discoverer but no one before Schofield has made it so clear that such discoveries were based on remarkable, if at times naïve, experimentation and on preternatural powers of observation. Priestley's apparatus was crude. Schofield graphically describes the fetid, black, effluvial water in the large pneumatic trough in which many of his greatest discoveries were made. The presence of adventitious gases is no doubt partly the reason for the variability in some of Priestley's findings. Priestley eagerly notes the flash of light when a candle is snuffed in gaseous ammonia; he ponders the occurrence of an inflammable gas where none is to be expected; and most miraculously of all he discovers the basic process of photosynthesis before he has isolated dephlogisticated air. Furthermore, he immediately places this last finding in its ecological framework ("I have discovered what I long have been in quest of, *viz*, that process in nature by which air, made noxious by breathing, is restored to its former salubrious condition").

Joseph Priestley was sixty years old when he immigrated to the United States and settled in the semi-frontier town of Northumberland, Pennsylvania. His intellectual powers were still high and his combative spirit undimmed ("even a dying hand has sometimes done execution"); but his philosophically abrasive mind needed something to rub up against. He chose to recognize that the young United States was not in as much need of his restless questioning as the England that he had reluctantly left. His theological writings continued virtually unabated; but, though he established a well-equipped laboratory, nothing of great moment came forth. His last ditch opposition to the new French chemistry, "Doctrine of Phlogiston established and that of the Composition of Water refuted," did nothing to stem the tide of its acceptance.

Robert Schofield has done this remarkable man proud. Others may write shorter and perhaps more popular biographies of Joseph Priestley, but they will do so in the shadow of this magisterial work. *Derek A Davenport, Purdue University*.

---

*Ladies in the Laboratory II – West European Women in Science, 1800 – 1900: A Survey of Their Contributions to Research***.** Mary R. S. Creese with contributions by Thomas M. Creese, The Scarecrow Press, Inc. Lanham, MD and London, 2004, xii + 285 pp, $69.95.

This book is a continued survey of women scientists who began their work in the nineteenth century as women were just beginning to emerge significantly within science communities. Like the earlier work by Mary Creese, *Ladies in the Laboratory? American and British Women in Science, 1800 -1900* [*Bull. Hist. Chem.*, **1998,** *25*, 132-133], it continues studies based on a bibliography of scientific journal articles from the London Royal Society's *Catalogue of Scientific Papers,* 1800 to 1900. The focus of this second book is the work of women in twelve Western European countries: Austria-Hungary, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Sweden, and Switzerland. The 177 women discussed in the book were responsible for about 20 percent of the papers referenced in the *Catalogue*. They worked in various areas of activity, biological and medical sciences, mathematical and physical sciences, and social sciences. The book also includes an appendix on British and American women either omitted from the first volume or for whom additional information has been obtained.

*Ladies in the Laboratory II* is both a valuable compendium of work done by women scientists in the nineteenth and early twentieth centuries and a fascinating recounting of their personal journeys as women and scientists. Each chapter covers a specific region and is organized by field of science. Chapters are headed with a useful abstract and end with a summary describing the place of that region's women within the scientific community. When chapters cover more than one country, e.g., Scandinavia, they are subdivided into countries. An overview of the societal trends and geopoliti-

cal situations in each country is given, and statistics showing distributions of authors and papers by decade and field are presented graphically. Creese then presents biographical information on the women, many of whom are little known outside their countries. Her intent is "….to offer a selected and ordered series of pictures of the lives and careers of many of the most notable nineteenth-century women of science in Western Europe."

Since universities in Western Europe began to open to women late in the nineteenth century, many of the women discussed began scientific careers in the 1880s and 1890s. Certain universities, especially those in Switzerland, were early in their education of women, and many formed lasting friendships while studying there. Creese describes contributions throughout a lifetime and hence a picture of both late nineteenth- and early twentieth-century women emerges. Several of the women were productive well into their seventies and eighties, serving as role models not only to young women but to those of all ages.

By telling their "stories" Creese brings these early scientists to life and makes them accessible to the reader. One gets a fascinating journey into the lives of exceptional women who overcame serious social and political constraints to lead productive lives as scientists and women. Their love for science and their persistence in continuing their studies inspire awe. Many worked in obscurity and others had to leave their countries to continue their studies. Political events interrupted their work, but they continued to contribute in their fields. They frequently had a strong social conscience and several were responsible for positive changes in health and education policies in their respective countries, and two at least had influence well beyond their regions: Marie Baum of Germany in industrial health and welfare and Maria Montessori of Italy in education. In addition, these women were aware of their unique positions in society and used these positions to advance the roles of women either by direct political action, mentoring, expanding opportunities, or serving as exceptional models of accomplishment.

These early women scientists were involved in numerous scientific fields, with contributions in botany particularly noteworthy. One of the enjoyable features of the book is learning of the interesting botanical work done at the turn of the century and the excitement of field exploration and discovery of new species. Work in other biological sciences, especially zoology, and in medicine and chemistry was also notable though less extensive. Again, it is a pleasure to read of early work in these fields. Several chemists and physicists-chemists are profiled including Naima Sahlbom (Sweden), Marie Curie (France), Marie Baum (Germany), Clara Immerwahr Haber (Germany), and Ida Welt (Austria). Agnes Pockels (Germany), whose work in surface properties is often claimed by the chemical community, is also described in depth but as a physicist.

*Ladies in the Laboratory II* includes extensive bibliographic references and the work is well documented. The book is useful for the scholar wishing to study activities in a particular field or country. For the more casual reader, the profiles are the most fascinating part of the work and one can return again and again to read of interesting science and to study intriguing lives. Marie Creese succeeds splendidly in casting a light on the lives of an important group of early women scientists. *Maureen Gillen Chan, Bell Laboratories, Lucent Technologies (retired).*

---

*The Life and Work of Friedrich Wöhler (1800-1882).* Robin Keen, J. Büttner, Ed., Verlag Traugott Bautz GmbH, Nordhausen, 2005; hardcover, 493 pp, 0, ISBN 3-99309-224-X, E 120.

This biography of the famous Friedrich Wöhler is based upon the Ph.D. dissertation written by Robin Keen at University College, London, in the 1970s. The author was directed in his historical research by the late William A. Smeaton. Having lain dormant for a quarter century, the richly informative treatise has now been transformed into a book after meticulous revision by William Brock (who served on Keen's oral doctoral examination in 1976) and final editing by Johannes Büttner, cofounder with the late Wilhelm Lewicki in 2000 of Edition Lewicki-Büttner. This Wöhler biography constitutes Volume 2 in the Lewicki- Büttner series, Vol-

ume 1 being *Stoffwechsel im tierischen Organisumus: Historische Studien zu Liebigs 'Thier-Chemie' (1842).*

Source materials are extensive: besides over 300 books and articles cited, Keen took advantage of the myriad letters exchanged between Wöhler and Liebig and between Wöhler and his cherished mentor and friend Berzelius. According to the editor, Keen's collection of correspondence includes several omitted from A. W. Hofmann's "Briefwechsel" published in 1888. Citations are carefully footnoted; even though many are necessarily repeated, the number of footnotes reached an impressive1,378.

Organization of the 23 chapters is chronological to a degree, in that Wöhler's life is traced from early days through his education and the year spent with Berzelius in Stockholm, followed by his positions in Berlin, Kassel, and finally Göttingen. Interspersed between these moves, however, are descriptions of Wöhler's varied research activities at each location, spanning his early work with aluminum in 1828 to his fascination with meteorites and minerals up to the end of his career. Because he frequently dropped one area of investigation to take up another, only to return to an earlier interest later, the author's treatment of each research area often spans decades or sometimes nearly his entire professional career. Wöhler had unusually broad interests. As Brock has stated in his foreward, "Wöhler refuses to be categorized as an inorganic, organic, or physical chemist." His early work in Berlin on urea earned lasting fame, as is well known, but his claim for the first isolation of aluminum also dates from the Berlin days, as does work on beryllium, yttrium, and vanadium (clearly inspired from his year with Berzelius). At Göttingen alone he investigated 23 elements, all described in some detail, while concurrently delving into organic chemistry. He published scientific articles numbering more than 500 over a period of 59 years, many coauthored with Liebig and some written in Swedish.

Although much of the work and probably all of the publications were done by Wöhler himself, he directed the research of many doctoral students in Göttingen over a time span of 30 years, beginning in 1841. Some but not all of these students can be found in appendices, either as assistants under Wöhler or professors who were his pupils. A full bibliography of Göttingen chemistry doctoral students was published in 1998 (G. Beer, *Die Chemischen Dissertationen der Universität Göttingen, 1734-1900*, Verlag Museum der Chemie, Göttingen).

What about Wöhler the man? The reader gains considerable insight into the individual: well educated, with knowledge of Latin, Swedish, and apparently Russian as foreign languages; possessed a keen interest in science from an early age; industrious and adventurous in his explorations; a prodigious reader, author, and correspondent. He made Berzelius' *Lehrbuch der Chemie* and *Jahresbericht* available to European readers by translating the many volumes into German from the original Swedish. This labor of dedication deprived Wöhler of untold weeks of time he might have devoted to his own investigations. Benefiting from a pleasing disposition, he was even tempered, abhorred confrontations and conflicts, and served effectively as a diplomat in controversies between Liebig and Mitscherlich and Liebig and Berzelius. Wöhler, charismatic and a genuine friend to many, frequently used his sense of humor in correspondence. In writing to Liebig in 1843 concerning Liebig's annoyance with Marchand, he reminded his colleague that by 1900 they all would have become ammonia, carbon dioxide, and water! The fact he was successful in collaborating with Liebig in research and editing is a measure of his good disposition.

The text is highly readable, although the treatment of individual research areas is sometimes difficult to follow because of the time spans covered. The many appendices enhance the book considerably. While the "Index of Personal Names" appears to be fairly extensive, the subject index is scant. Typographical errors, inevitable in view of the final preparation by individuals with different native languages, do not usually distract from the meaning. English-speaking readers may well be confused, however, to learn about a "3.000-word letter" written by Berzelius to Liebig. This welcome biography of one of the giants of 19$^{th}$-century chemistry, in English, will serve historians of chemistry most effectively. We owe an immense debt of gratitude to the original author and those who had the persistence to realize its evolution into a full-length book. *Paul R. Jones, University of Michigan.*

*A Well-Ordered Thing. Dmitrii Mendeleev and the Shadow of the Periodic Table.* Michael D. Gordin, Basic Books, New York, 2004; hardover, xx + 256 pp, $30.

This book is by no means a classical biography, as the author himself warns in the preface: "What follows is not a traditional biography. Here is no comprehensive account of every aspect of the adult Mendeleev's life, and we encounter precious little of his childhood." The promise is kept. Overall, Gordin provides an assessment of Mendeleev that is consistent, although I am not certain that I agree with all his conclusions. Nevertheless, I am comfortable recommending the book to those with an interest in Mendeleev and Russian chemistry in the last half-century of Tsarist Russia.

Dmitrii Ivanovich Mendeleev, the subject of this book, is perhaps the most identifiable Russian chemist of the last two centuries. A major part of the familiarity of western chemists with Mendeleev is actually an acquaintance with his first major discovery: the Periodic Table of the Elements and the Periodic Law. I was fascinated to find out that I was nowhere near as familiar with Mendeleev, the man, as I thought I was; and this book has substantially altered my perspective on the man behind the science. What emerges from Gordin's narrative is a complex man living in some of the most interesting times of recent Russian history: the reigns of Alexander II, the great reformer, assassinated in 1881, and his son, Alexander III, whose reign was characterized by the roll-back of many of those same reforms.

As Gordin views it, Mendeleev's career was really two rather disparate careers, with a dividing point in time of the defeat of his nomination to the Imperial Academy of Sciences in St. Petersburg. Prior to this seminal event in Mendeleev's life, Gordin views him as predominantly the scientist, for whom organizing science was a major thrust of his efforts, while afterward, his vision became much more imperial (rather than local), and his efforts became much more involved with using the imperial bureaucracy to effect change.

The book is organized in roughly chronological order of the topics discussed, although the various chapters obviously overlap in time. The first half of the book (roughly) deals with many of the facets of Mendeleev's scientific life as a professor in St. Petersburg, as he built his reputation in the scientific community, while the second half of the book concentrates on the more bureaucratic work of the established scientist.

The first chapters of the book deal with the development of Mendeleev, the fully mature scientist. It begins with a discussion of a seminal event in chemistry, the Karlsruhe Conference of 1860, where Stanislao Cannizzarro proposed his atomic weights for the elements, based on the earlier work of Amedeo Avogadro. Mendeleev himself saw his attendance at this meeting as a watershed in his early career, and Gordin makes some interesting points about the way in which Mendeleev used his attendance at this meeting to further his own career and raise his visibility in Russia.

This is followed by a discussion of the development of the Periodic System of Elements and its evolution into the Periodic law, an excellent chapter, where Gordin gives a lucid account of this advance, and where he debunks some long-held myths about how Mendeleev developed his periodic system. He also raises some interesting questions for the reader, among which is the question of how Mendeleev himself, who (like many of his contemporaries) did not embrace the concept of atomism as a physical reality, but who adhered to the concept of "chemical atomism," viewed the periodic system of elements that he had developed as a teaching tool. The beginnings of the Periodic System as a pedagogical problem, rather than as a fundamental research problem, and the evolution of the system as a problem from the realm of teaching to that of "pure science," are most revealing.

Although known best for his development of the periodic system of elements, Mendeleev actually finished his work on this topic fairly early and by 1872 had ended his own original work in the area, although he did continue to follow the work of others as they confirmed his predictions over the next decade and a half. His next great opus was work with gases. Mendeleev's work with gases had, as its ultimate goal, finding experimental evidence for the existence of the luminiferous ether by observing the behavior of gases at low pressures. The tale told is how Mendeleev sought out funding for his *low-pressure* gas experiments—based on *high-pressure* experiments to be carried out—and how he organized his laboratory assistants to accomplish the goals of what was a "big science" program. In many ways, this chapter best illustrates Mendeleev, the man. It begins with a somewhat scathing assessment of Mendeleev himself by his contemporary, organic chemist Fedor Fedorevich (Friedrich Konrad) Beilstein, who apparently harbored a healthy skepticism of Mendeleev's periodic law.

The next two chapters were, for me, the most enjoyable of the book. They describe the two great battles of Mendeleev's professional and personal life: his work against spiritualism and his battle to be elected to the Imperial (Petersburg) Academy of Sciences. In these two chapters the life of the chemistry and broader science establishments of St. Petersburg are laid out. Gordin's well written discussions of the political undertones of these two seminal events in Mendeleev's life contain a view of the major protagonists that are sometimes at odds with the traditional views of the great Russian chemists of the nineteenth century.

Spiritualism had become a major force in Europe during the nineteenth century, counting many reputable scientists among its adherents. Indeed, Gordin's account of Butlerov's gradual alignment with the spiritualists was particularly illuminating for me. Mendeleev saw it as his job to help discredit it, believing that these reputable scientists gave it a "scientific" status that it did not deserve (much like Kolbe saw Wislicenus giving stereochemistry a status it did not merit). The debates over spiritualism as described by Gordin work to overcome the popular mythology that has grown up around this topic, but it is at the expense of the "noble" Mendeleev, who occasionally appears to be more ideologue than dispassionate seeker after truth.

The battle over Mendeleev's candidacy for election to the Imperial Academy of Sciences was a turning point in his life, but it was also a seminal event of the development of a "Russian" identity of science in Russia. Like many, I was somewhat acquainted with this story, but I did not know the details. Gordin has done an excellent job of discussing this event and its wider implications; again, not all the protagonists emerge with their reputations unsullied. Butlerov, in particular, emerges as a man who allowed his national pride to overcome his better judgment, and who was willing to sacrifice friendship for nationalistic principle.

I found the second half of the book much more difficult to read, perhaps because of a lack of social sciences in my own background. It begins with Gordin's assessment of Mendeleev's reaction to being denied election to the Academy of Sciences. There is little doubt that the losing fight over Academy membership took its toll, and in the first chapter of the second half of the book, we see the evolution of his views on scientific societies, among others, in response to his rejection. Following his rejection by the Academy, Mendeleev's emphasis shifted, becoming increasingly bureaucratic (in the sense of organizing and standardizing the various functions of government). He used his closeness with Tsar Alexander III and his position in the Chief Bureau of Weights and Measures to make imperial Russia a laboratory for his economic theories, as he led the modernization effort, including his attempts to introduce the metric system and his introduction of tariffs to encourage domestic economic growth in the face of international competition. His views on the use of tariffs are remarkably modern; similar views are being espoused today.

This chapter is followed by an assessment of the development of Mendeleev's persona and a critical examination of the legends that surround him (e.g., his "Siberian-ness," which is compared with the romance of the "wild west" in American folk-lore), and Mendeleev's own role in developing his public image. The chapter concludes with the transformation of the image of Mendeleev, a life-long conservative and supporter of the Tsar, into a "radical" romantic and his dismissal from his post at St. Petersburg University (a similar fate awaited Markovnikov a few years later). Gordin makes the point that this transformation of Mendeleev's image was not coupled to a transformation of the man. I found Gordin's arguments about Mendeleev's probable motives to be persuasive; the image of Mendeleev as a radical liberal is inconsistent with the bureaucrat who emerges during the preceding chapters.

This dismissal from St. Petersburg University provides the introduction to the penultimate chapter, which deals with the last years of Mendeleev's life and with the collapses that led to the revolution of 1905 and his withdrawal from public life. To the end, Mendeleev is portrayed as being a staunchly loyal Tsarist, who did not believe that a republic was a viable form of government for Russia.

In the final chapter of the book, "Conclusion: The Many Mendeleevs," what emerges is a well-rounded portrait of a man who, Gordin implies, may serve as a model for both his times and his country. The Mendeleev who emerges from Gordin's treatment is not the mildly eccentric Mendeleev of popular chemistry folk-lore, but a complex individual: an ambitious man who played a central role in the development of Russian science after passage of the Great Reforms, accumulated significant influence over Russian science, and saw his own role in the Russia emerging from the Great Reforms as central to the modernization of Russian society, politics, and economics.

The narrative is extensively annotated and supported by nearly 60 pages of notes and a 40-page bibliography; the level of scholarship is impressive. However, I was disappointed with the index, which occupies a scant seven pages in three-column format, is quite sparse compared to the notes and bibliography, and which is not as useful as it should be.

The clear strength of this book is in the study of the man, Mendeleev. However, the author's insight into the chemistry underlying that man's work is not one of its strengths. There are occasional places where Gordin's commentary is somewhat confused, betraying a less-than-commanding grasp of the underlying chemistry, especially when he addresses more modern concepts, and this will temper the enjoyment of the book by the chemist reader. From my own perspective, one of the best facets of this book is that it lays out—albeit somewhat indirectly—the effects of the Great Reforms of Alexander II and the effects of the University Statute of 1863 on the development of Russian chemistry during the second half of the nineteenth century. *David E. Lewis, Department of Chemistry, University of Wisconsin-Eau Claire, Eau Claire, WI 54702-4004.*

---